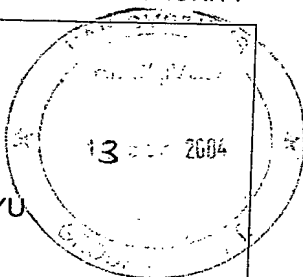


# PATENT COOPERATION TREATY

From the  
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

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## PCT

### NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

Date of mailing  
(day/month/year)

09.09.2004

Applicant's or agent's file reference  
XA1669

#### IMPORTANT NOTIFICATION

International application No.  
PCT/GB 03/03081

International filing date (day/month/year)  
15.07.2003

Priority date (day/month/year)  
30.07.2002

Applicant  
MBDA UK LIMITED et al.

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

#### 4. REMINDER

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

The applicant's attention is drawn to Article 33(5), which provides that the criteria of novelty, inventive step and industrial applicability described in Article 33(2) to (4) merely serve the purposes of international preliminary examination and that "any Contracting State may apply additional or different criteria for the purposes of deciding whether, in that State, the claimed inventions is patentable or not" (see also Article 27(5)). Such additional criteria may relate, for example, to exemptions from patentability, requirements for enabling disclosure, clarity and support for the claims.

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# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY EXAMINATION REPORT (PCT Article 36 and Rule 70)

Applicant's or agent's file reference XA1669		<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA/416)	
International application No. PCT/GB 03/03081		International filing date (day/month/year) 15.07.2003	Priority date (day/month/year) 30.07.2002
International Patent Classification (IPC) or both national classification and IPC G02B6/26			
Applicant MBDA UK LIMITED et al.			
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 10 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 2 sheets.</p>			
<p>3. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> <li>I <input checked="" type="checkbox"/> Basis of the opinion</li> <li>II <input type="checkbox"/> Priority</li> <li>III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</li> <li>IV <input type="checkbox"/> Lack of unity of invention</li> <li>V <input checked="" type="checkbox"/> Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</li> <li>VI <input type="checkbox"/> Certain documents cited</li> <li>VII <input type="checkbox"/> Certain defects in the international application</li> <li>VIII <input type="checkbox"/> Certain observations on the international application</li> </ul>			
Date of submission of the demand  09.02.2004		Date of completion of this report  09.09.2004	
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465		Authorized Officer  Frisch, A  Telephone No. +49 89 2399-7048 	

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/GB 03/03081

**I. Basis of the report**

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17):*

**Description, Pages**

1-8 as originally filed

**Claims, Numbers**

1-14 received on 28.08.2004 with letter of 26.08.2004

**Drawings, Sheets**

1/4-4/4 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).  
☐ the language of publication of the international application (under Rule 48.3(b)).  
☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.  
☐ filed together with the international application in computer readable form.  
☐ furnished subsequently to this Authority in written form.  
☐ furnished subsequently to this Authority in computer readable form.  
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.  
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:  
☐ the claims, Nos.:  
☐ the drawings, sheets:

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. **PCT/GB 03/03081**

5. ☒ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

**see separate sheet**

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Yes: Claims	6,13,14
	No: Claims	1-5,7,8,9,10,11,12
Inventive step (IS)	Yes: Claims	
	No: Claims	6,13,14
Industrial applicability (IA)	Yes: Claims	1-14
	No: Claims	

2. Citations and explanations

**see separate sheet**

**Re Item I**

1.1 The applicant has amended his application by filing a new set of claims. Claims 1 - 4, 6 - 10, and 12 - 14 thereby correspond at least in part to previous claims 1 - 12, respectively, with the exception that it was tried to define the coating and the cladding material, their position on the fibre core, and the relation to each other more precisely. Claims 5 and 11 have been newly added.

1.2 However, new claim 1 now contains the features that the "external diameter of the reflective coating is less than the external diameter of the cladding material". Despite the fact that this definition is in contradiction to the definitions of new claims 2, 4, 5, 6, 7, and 12 (which claims define inter alia that the reflective coating covers the outer surface of the cladding in which case the external diameter of the reflective coating is greater than the external diameter of the cladding and not vice versa, as defined in new claim 1), it appears that the only embodiment for which the definition of claim 1 applies is the embodiment shown in figure 7:

in this case the reflective coating covering the fibre core in a first 'longitudinal' portion thereof has actually an external diameter which is always less than the external diameter of the cladding.

There is no other embodiment disclosed in which this is the case, and there does not exist any indication nor any hint in the application documents as originally filed that this feature could or should also be present for other embodiments disclosed.

It thus appears that new claim 1 now only contains one arbitrarily selected feature of the embodiment shown in figure 7 of the present application which feature additionally does not fit to all other embodiments disclosed such that the feature combination of new claim 1 is considered as introducing subject-matter which was not present in the application documents as originally filed.

Since the feature "external diameter of the reflective coating is less than the external diameter of the cladding material" in new claim 1 is thus not admissible, it will not be taken into account in the following when discussing novelty and inventive step (Rule 70.2 PCT).

1.3 A similar objection applies also to new claims 10 and 11:  
new claim 10 now contains one part of the subject-matter of previous claim 9  
whereas new claim 11 contains the additional features of the remaining other part

of the subject-matter of previous claim 9, i.e. new claim 10 contains the features that the coated and the clad fibre core part form different separate parts which are joined and optically coupled and new claim 11 contains the additional feature that tapered cladding material surrounds the region where the two parts are joined.

However, as has been made already clear above, these features have been only disclosed in combination:

all embodiments for a fibre core with cladding and a light pipe joined to each other comprise a tapered cladding in the region where the two are joined, see figures 8 and 10, and there is no indication nor any hint in the application documents as originally filed that the tapered cladding should or could be dispensed with. It is thus considered that the splitting of the subject-matter of previous claim 9 into two claims introduces subject-matter which goes beyond the content of the application documents as originally filed and thus contravenes Rule PCT.

Since the splitting of the subject-matter of previous claim 9 into two claims thus is not allowable, it will not be taken into account in the following.

#### **Re Item V**

Reference is made to the following documents:

- D1: DE 36 25 106 A (VEB ELEKTROANLAGEN UND GERÄTEBAU GREIZ) 26. February 1987
- D2: EP-A-0 763 742 (KANAGAWA ACADEMY OF SCIENCE AND TECHNOLOGY) 19. March 1997
- D3: PATENT ABSTRACTS OF JAPAN vol. 1996, no. 03, 29. March 1996 (-& JP 07 311323 A (SEIKO GIKEN:KK), 28. November 1995
- D4: US-A-3 756 688 (HUDSON M ET AL) 4. September 1973

- 1.1 The application does not fulfil the requirements of Article 6 PCT. The reasons for this objection are:
- 1.2 It is not clear from the terms "by means of internal reflection" and "will cause the electromagnetic radiation to travel along" in claim 1 if there exists a difference between the two material covering the fibre core or not. It is furthermore not clear that a cladding material which works via total internal refraction and a reflective

coating are meant.

1.3 It is not clear from the description how the two different materials of the fibre core as defined in claim 9 are achieved. The subject-matter of claim 9 thus appears to be not supported by the description.

1.4 It is not clear from claim 10 if the two different parts of the coupling arrangement, i.e. the pipe and the clad fibre, are arranged in an abutting or in a non abutting optical coupling arrangement (as e.g. a lens displaced from a fibre end). It is however understood from the description and shown in figures 9 and 10 of the application that the two are arranged in an abutting relationship. It is furthermore not clear from the term "in the region" of claim 10 that the tapered cladding not only surrounds the core of the clad fibre but also a part of the core of the light pipe as it is shown in figures 9 and 10 and described on page 7, line 4 - 29 of the application. Claim 10 is thus unclear as such and unclear in view of the description.

It is furthermore understood from the description of the embodiments shown in figures 9 and 10 and described on page 7, line 4 - 29 that the tapered part of the cladding must be partially covered by a reflective coating (e.g. the coating of the pipe) in order to prevent light leakage out of the coupling arrangement (page 7, line 7 - 10). Claim 10 is thus additionally unclear in this respect.

In this context it should be noted that the above essential feature is included in claim 12.

2.1 The application does not fulfil the requirements of the PCT because the subject-matter of claim 1, as far as it is understood and allowable, is not new in the sense of Article 33(2) PCT:

Document D1 describes an optical fibre having a generally cylindrical core of which a first 'longitudinal' portion is covered by an 'inwardly facing' reflective coating to cause electromagnetic radiation to travel along the first part of the optical fibre core by means of internal reflection (col. 2, line 48 - 56) and further having a second 'longitudinal' portion which is covered by a cladding material having a refractive index that will cause electromagnetic radiation to travel along the second part of the optical fibre core (i.e. the polymer cladding, col. 2, line 48 - 56). This fibre termination allows to fix several fibres close to each other in a common connector (col. 2, line 8 - 36).

All features of the subject-matter of claim 1 are thus known in combination from the fibre described in D1.

The subject-matter of claim 1 is also anticipated by fibres generally known from scanning probe methods (e.g. STM, AFM, or SNOM) and from fibre couplers:

Figure 9 of document D2 shows a fibre used in scanning probe methods. The fibre comprises a core (12, see also page 10, line 40 - 50, col. 12, line 20 - col. 13, line 16) with a reflective coating (46) along a first part of its length (as can be seen in figure 9) such that electromagnetic radiation may travel along the first part of the optical fibre by means of internal reflection (as it is known to the skilled person) and further having a cladding (13) along a second part of its length (as can be seen in the figure), the cladding having a refractive index suitable for permitting the electromagnetic radiation to travel along a second part of the optical fibre (as implicitly clear to the skilled person).

All features of the subject-matter of claim 1 are thus known in combination from the fibre described in D2.

Figure 1 of document D3 and figures 1, 3, and 4 of document D4 show a fibre (D3: 200; D4: 10) comprising a core (D3: 200f; D4: figure 1: 12, figure 3: 68; figure 4: 102, 100, 98) with a reflective coating (D3: 200d; D4: figure 1: 18, figure 3: 72, figure 4: 112) along a first part of its length (as can be seen in the figures) such that electromagnetic radiation may travel along the first part of the optical fibre core by means of internal reflection (as it is known to the skilled person, see also D4: col. 5, line 5 - 50) and further having a cladding (D3: 200e; D4: figure 1: 14, figure 3: 78, figure 4: 104) along a second part of its length (as can be seen in the figures), the cladding having a refractive index suitable for permitting the electromagnetic radiation to travel along a second part of the optical fibre (as implicitly clear to the skilled person).

All features of the subject-matter of claim 1 are thus known in combination from the fibres described in D3 and D4.

- 2.2 The application does not fulfil the requirements of the PCT because the subject-matter of claims 13 and 14 does not involve an inventive step in the sense of Article 33(3) PCT:



Document D1 describes optical fibres having a core with a reflective coating along a first part of its length such that electromagnetic radiation may travel along the first part of the optical fibre by means of reflection (col. 2, line 48 - 56) and further having a cladding along a second part of its length, the cladding having a refractive index suitable for permitting the electromagnetic radiation to travel along a second part of the optical fibre (i.e. the polymer cladding, col. 2, line 48 - 56). This fibre terminations allow to fix several fibres close to each other in a common connector (col. 2, line 8 - 36).

The optical arrangement described in D1 differs from the optical fibre arrangement of claims 13 and 14 in that only two fibres are arranged close to each other (one would not call this an array where generally more than two fibres are combined) and in that the fibres do not terminate in an electromagnetic detection device.

It is, however, immediately obvious from the teaching of D1 that the main advantage of the fibre terminations described (i.e. less space is needed which allows a higher resolution) also apply for an arrangement of more than two fibres, i.e. for a fibre array. It is furthermore immediately obvious that such an array allowing a higher resolution due to increased fibre termination density consequently provides a higher intensity of light out coupled therefrom. Therefore it is also obvious to use the fibre terminations known from D1 in a fibre array if a high intensity output (corresponding to a high spatial resolution or fibre density) in a coupling arrangement with a radiation detector is needed.

- 2.3 Dependent claims 2 - 8 do not appear to contain any additional features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT with respect to novelty or inventive step. The reasons for these objections are:

Claims 2- 5

The cladding of the fibres shown in figures 9 and 1 of documents D2 and D3, respectively, is already tapered and comprises a reflective coating on its outside surface, whereby the thinnest part of the taper is directed towards the first portion of the fibre core, and wherein the reflective coating of the cladding is formed integral with reflective coating of the first fibre core portion. The subject-matter of claims 2 - 5 thus is not new in the sense of Article 33(2) PCT.

Claims 7 and 8

The first coated part of the fibres shown in figures 9 and 1 of documents D2 and

D3, respectively, comprises already a layer of cladding between the fibre core and the reflective coating, and said layer of cladding is also substantially thinner than the cladding of the second part of the fibre, said layer being sufficiently thin to permit electromagnetic radiation to travel along the first part of the optical fibre core by means of internal reflection. The fibres also comprise an optical fibre where the cross section of the fibre core of a the first fibre part differs from the cross section of the fibre core of the second fibre part (as can be seen in the figures)

The subject-matter of claims 7 and 8 is thus not new in the sense of Article 33(2) PCT.

Claim 9

Figure 5 of document D4 shows a fibre similar to the fibre shown in figure 1 of D4. This fibre comprises a core where the core material differs along the fibre axis. The subject-matter of claim 9 is thus not new in the sense of Article 33(2) PCT.

Claim 6

If the cladding of a fibre is sufficiently thick there will be no need for a reflective coating (as generally known, see e.g. the relevant passages of D4 cited already above). On the other hand it is also immediately clear that the reflective coating has to have a certain thickness in order to prevent light losses in the case where there is no or not sufficient cladding material around the core. It is thus immediately obvious that the reflective coating has to be thicker at the thinner end of the tapered cladding and the subject-matter of claim 6 therefore does not involve an inventive step in the sense of Article 33(3) PCT.

- 2.4 In this context it should be noted that the subject-matter of claims 2 - 8 also lacks an inventive step (Article 33(3) PCT) when taking into account the teaching of D1 and the general knowledge of a person skilled in the art: even though document D1 does not explicitly mention it, it is immediately clear to the skilled person and already indicated in the figure that the fibre described in D1 exhibits some sort of transition region between the clad and the coated part of the fibre. It is furthermore known to the skilled person that abrupt changes in fibre parameters (e.g. cross sections/cladding thickness etc.) lead to additional losses which can be prevented by an (adiabatic) tapering of cladding or/and core (as shown in D2, see also D3: figure 1, and D4: figure 1 and col. 3, line 35 - col. 6, line 37 and the abstract) and/or an additional reflective coating of the tapered cladding, as also shown in D2, D3, and D4. Tapering the cladding and coating the cladding partly with a

reflective coating and with the greatest coating layer thickness at the thinner end of the cladding are thus features which are known from other fibre terminations and which have there already been employed for the same purposes. It is therefore obvious to the person skilled in the art, to apply these features with corresponding effects to the fibre termination known from document D1 if desired, thus arriving at the subject-matter of claims 2 - 8. Consequently, the subject-matter of claims 2 - 8 also appears to lack an inventive step.

3. The application does not fulfill the requirements of the PCT because the subject-matter of claim 10, as far as it is understood and allowable, and the subject-matter of claim 12 is not new in the sense of Article 33(2) PCT:

Figure 1 of document D3 shows a fibre optic coupling arrangement for coupling a light pipe (200) to a clad optical fibre (210). The coupling arrangement comprises a light pipe (200) comprising an optical fibre core (200f) having a reflective coating (200c) and a clad optical fibre (210) comprising an optical fibre core with cladding surrounding the core (see abstract). The optical fibre core of the light pipe is optically joined to the optical fibre core of the clad optical fibre such that electromagnetic radiation is able to travel from the light pipe to the clad optical fibre (see abstract, purpose of the invention). The cladding is tapered in the region where the light pipe is optically joined to the clad optical fibre (as can be seen in the figure) and at least a part of the tapered cladding is coated with a reflective coating (as can be seen in the figure).

All features of the coupling arrangement of claims 10 and 12 are thus known in combination from the coupling arrangement shown in figure 1 of document D3.

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## CLAIMS

1. An optical fibre having a generally cylindrical core of which a first longitudinal portion is covered by an inwardly facing reflective coating to cause electromagnetic radiation to travel along the first longitudinal portion of the core by means of internal reflection, a second longitudinal portion is covered by a cladding material having a refractive index that will cause the electromagnetic radiation to travel along the second longitudinal portion of the core, and the external diameter of the reflective coating is less than the external diameter of the cladding material.
2. An optical fibre, as in Claim 1, in which the reflective coating extends over an end of the cladding material.
3. An optical fibre, as in Claim 1 or Claim 2, in which the end of the cladding material is tapered, and the thinnest part of the taper is directed towards the first portion of the core.
4. An optical fibre, as in Claim 3, in which the exterior of the tapered end of the cladding material has an inwardly facing reflective coating.
5. An optical fibre, as in Claim 4, in which the inwardly facing reflective coating of the exterior of the tapered end of the cladding material is formed integral with the coating of the first portion of the cylindrical core.
6. An optical fibre, as in Claim 4 or 5, in which the reflective coating is thickest at the thinnest part of the taper.
7. An optical fibre, as in any preceding claim, in which a layer of the cladding material is positioned between the cylindrical core and the reflective coating, this layer of cladding being substantially thinner than the cladding of the second portion of the core and sufficiently thin to permit electromagnetic radiation to travel along the first portion of the core by internal reflection.
8. An optical fibre, as in any preceding claim, in which the first portion of the core has a different cross-section to the second portion of the core.

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9. An optical fibre, as in any preceding claim, in which the first and second longitudinal portions of the core are formed from different materials.
10. An optical fibre, as in Claim 9, in which the first longitudinal portion of the core is a light pipe and the second longitudinal portion of the core is an optical core, and the light pipe is optically joined to the optical core to permit electromagnetic radiation to travel from the light pipe into the optical core.
11. An optical fibre, as in Claim 10, in which tapered cladding material surrounds the region where the light pipe is optically joined to the clad optical core.
12. An optical fibre, as in Claim 11, in which the tapered cladding material is at least partially covered by the inwardly facing reflective coating.
13. An array of optical fibres comprising a plurality of optical fibres according to any preceding claim, in which the first longitudinal portions of the optical fibres are arranged closely side-by-side.
14. An array of optical fibres, as in Claim 13, in which the second longitudinal portion of each of the optical fibres terminates in an electromagnetic radiation detection device.